Consolidated Field Comments for Draft TSO C-164a

#	Document Name	Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution	Comment Type (Conceptual, Editorial, or Format)	Disposition/Response to Comment
Comments Submitted By:			Kelly McGuckin					
Organization:			ANM-130S					
Phone:			425-917-6490					
1	TSO C-164A Night Vision Goggles	1	3.a.	Functionality. This TSO's standards apply to equipment intended to provide the pilot with amplified vision outside the aircraft in flight visual meteorological conditions (VMC).	Prefer "enhanced" over "amplified". If amplified is used, light should be added in conjunction.	Functionality. This TSO's standards apply to equipment intended to provide the pilot with **light** amplified vision outside the aircraft in flight visual meteorological conditions (VMC).	Editorial	Partially incorporated. "Light amplified"technically inaccurate. "Image intensified" better terminology. NVGs amplify more than visible wavelength "light".
2	TSO C-164A Night Vision Goggles	2	3.b.(1)	Total loss of the function defined in paragraph 3.a. when operating with the night vision goggles under the premise of RTCA/DO-268, Concept of Operations - Night Vision Imagining System for Civil Operators, dated March 27, 2001, is a major failure condition.	Added reference for major failure condition.	Total loss of the function defined in paragraph 3.a. when operating with the night vision goggles under the premise of RTCA/DO-268, Concept of Operations - Night Vision Imagining System for Civil Operators, dated March 27, 2001, is a major failure condition **as defined in AC 25.1309-1A.**	Editorial	Rejected. Failure conditions defined in DO-275 paragragh 1.8
3	TSO C-164A Night Vision Goggles	4	5.a.(1)	Operating instructions and equipment limitations sufficient to describe the equipment's operational capability. Include a note with the following information.	Added information - I wasn't sure if this was the best place for this information but felt this information was important.	Operating instructions and equipment limitations sufficient to describe the equipment's operational capability. **STC approved modifications to the aircraft cockpit lighting and displays are often required to allow the use of NVGs.** Include a note with the following information.	Conceptual	incorporated with modification.
4	TSO C-164A Night Vision Goggles	5	5.f.	Identify functionality or performance contained in the article not evaluated under paragraph 3 of this TSO (that is, non-TSO functions). Non-TSO functions are accepted in parallel with the TSO authorization.	Clarification	Identify functionality or performance contained in the article not evaluated under paragraph 3 of this TSO (**defined as** non-TSO functions). Non-TSO functions **can be** accepted in parallel with the TSO authorization.	Editorial	referred to Doug Law to see if this revised wording should be used in the standard TSO template.
Comments Submitted By:			N. Phan-Tran					
Organization:			ANM-130L					
Phone:			562-627-5343					
5	TSO C-164A Night Vision Goggles	1	3.a	The equipment is portable (battery powered).	Should we address concerns of using Lithium battery?	Refer to TSO-C142a for non-rechargeable cells/battery.	Conceptual	referred to Norm Pereira for comment

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Comments Submitted By:			Norm Pereira					
Organization:			AIR-133					
Phone:			202-267-1639					
5R	TSO C-164A Night Vision Goggles	1	3.a	The equipment is portable (battery powered).	Should we address concerns of using Lithium battery?	I did go through the document RTCA DO-275 and see that they call out “independent power sources” as the means of powering these NVG’s. There Is no mention of the types of possible power sources. There is also no mention of whether the power source can be rechargeable or non-rechargeable. We may want to add in appendix 1 that is the power source is lithium battery, the power source needs to be TSO C142a for non-rechargeable lithium batteries and TSO c179a if they are rechargeable lithium battery (I am not sure they want to use rechargeable, but if they do) You may also want to look at what we did on power sources for the ELT, TSO c126c. we have the power sources stipulated.	Conceptual	Incorporated, added Battery Standards to the appendix.
Comments Submitted By:			Martin Papanek					
Organization:			ACE-117C					
Phone:			(847)294-8114					
6	TSO C-164A Night Vision Goggles	1	2.c	Batteries used for this TSO article .... as long as they meet requirements in paragraph 3.c.	This paragraph refers to paragraph 3.c. for battery requirements.Paragraph 3.c. further refers to paragraph 5.a.(1) in a note.Paragraph 5.a.(1) does not discuss battery requirements whatsoever. As a reader of this TSO, one is never told where to get requirements for a battery in a Night Vision Goggle system.	Reference Battery requirements with a direct reference in paragraph 2.	Editorial	Incorporated with modification. Rewrote 3.c to require documentation of what types of batteries are authorized with the TSO device.
Comments Submitted By:			Andy Gardos					
Organization:			ASW-100					

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Phone:			817-222-5776					
7	TSO C-164A Night Vision Goggles	2	3.c	If you meet this requirement by providing a visual-alert, then the time available between the alert and actual loss of power to the tubes must be a minimum of 30 minutes.	The manufacturers of NVGs (at least L3) base their low power warning on a minimum voltage recognition which corresponds loosely to a time-limit (I believe around 20 minutes or so). This is accomplished to be more consistent rather than evaluating different types of batteries, etc. although in either case (time or voltage) the voltage dissipation rate dictates the amount of time remaining. The time prior to failure could also be reduced from 30 minutes to 20 minutes. This would still allow ample time for a pilot to change batteries or transition to unaided flight.	Recommend giving the manufacturer an option of a minimum voltage warning (corresponding to approximately 20-minutes or remaining battery life). It could be stated as follows: "If you meet this requirement by providing a visual-alert, then the voltage available between the alert and actual loss of power to the tubes must be a minimum of XXX volts."	Editorial	Rejected. A voltage remaining alert is a form of a visual alert. The voltage levels corresponding to time from that alert to shutdown are necessarily design dependent and are properly left to the manufacturer as to the mechanism to achieve the minimum performance.
8	TSO C-164A Night Vision Goggles	2	3.c note	Battery technologies utilizing different chemical compositions could have significantly different discharge characteristics. Therefore, manufacturers should specify which battery models/types have been evaluated in meeting the above visual-alert requirement. This limitation should be documented as required by paragraph 5.a.(1) of this TSO.	Requiring the NVG manufacturer to evaluate and list compatible batteries is cumbersome and potentially complicates use for the end user if the specific batteries tested are unavailable.	Recommend removal of limitation/specification of evaluated battery models/types. If battery type must be kept, I recommend changing the time-based warning to a voltage-based warning (guaranteeing approximately 20-minutes or remaining life).	Editorial	Modified. Different battery chemistries do have different discharge characteristics. Note deleted and changed to a requirement to document the type of battery chemistry but not specific battery model tested and authorized.
9	TSO C-164A Night Vision Goggles	3	4.b	Each component that is easily removable (without hand tools); and , Each subassembly of the article that you determined may be interchangeable.	Is the intent of this section to require manufacturer to mark the NVG tubes (for a traditional binocular design)? Applicants have asked this question as the TSO wording (and proposed changes as well) are not fully clear. Is it our position that the tubes must be marked per 4.b(2) since we consider the tubes, at least in like pairs, to be interchangeable.	Recommend stating that NVG tubes must be marked per 4.b requirements.	Editorial	Accepted.

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10	TSO C-164A Night Vision Goggles	4	5.a(1)	The user should refer to Advisory Circular (AC) 27-1B or 29-2C, Chapter 3, Miscellaneous Guidance (MG) 16, Certification Procedure for Rotorcraft Night Vision Imaging Systems (NVIS) Equipment, as appropriate, for certification guidance on determining compatibility of the appliance with the aircraft environment.	This required note only references rotorcraft guidance material. Are fixed-wing considerations purposefully left out? This may cause confusion for fixed-wing applications, which have recently been issued multiple NVIS STCs.	Including guidance material for fixed-wing aircraft environments.	Conceptual	Modified. The guidance material for fixed wing installations does not exist. Removed reference to Rotorcraft certification guidance. Rewrote required manual statement.
11	TSO C-164A Night Vision Goggles	4	5.a(3)	Installation procedures…sufficient to ensure that the night vision goggles, when installed according to the installation or operational procedures, still meet this TSO's requirements. Limitations must identify any unique aspects of the installation.	What is meant by "installation" of the NVGs? This may be unclear to the manufacturers seeking TSO. Section 3.a clearly stated that the "…equipment is portable (battery powered), with no interface with aircraft systems. Manufacturers wishing to develop night vision goggles that utilize alternate power sources must apply for a deviation..."	Remove references to installation of NVG in this context. If there is added value in addressing installation, please clarify what this entails.	Conceptual	Modified. Rewrote required statement in 5.a.(1)
12	TSO C-164A Night Vision Goggles	4	5.a(4)	For each unique configuration of software and airborne electronic hardware, reference the following:	The manufacturers seeking TSO should also include similar information (such as NVG part number and functional description) of any unique configuration (e.g. phosphor type, etc.; not just of those differentiated by software or AEH).	Add a new subsection referencing unique configurations prior to 5.a(4) which only accounts for uniqe configurations of software and AEH.	Conceptual	5.a.(7) requires a list of replacable components by part number which should cover configuration differences referenced.
13	TSO C-164A Night Vision Goggles	5	5.f(2)	Installation procedures and limitations sufficient to ensure that the non-TSO function(s) meets the declared functions and performance specification(s) described in paragraph 5.f.(1).	What is meant by "installation" procedures of the NVGs? This may be unclear to the manufacturers seeking TSO. Section 3.a clearly stated that the "…equipment is portable (battery powered), with no interface with aircraft systems. Manufacturers wishing to develop night vision goggles that utilize alternate power sources must apply for a deviation..."	Remove references to installation of NVG in this context. If there is added value in addressing installation, please clarify what this entails.	Conceptual	Modified. Rewrote required statement in 5.a.(1)
14	TSO C-164A Night Vision Goggles	6	5.h	Material and process specifications list.	Does this list refer to the materials and processes used for the manufacture of the TSO article itself?	Clarify.	Editorial	Refered to Doug Law for possible TSO template update

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15	TSO C-164A Night Vision Goggles	6	5.i	List of drawings and processes (including revision level) that define the article's design.	What is the difference between the required list of "processes" in 5.i and "process specifications" in 5.h?	Clarify what the differences are between "process specifications" required in 5.h and "processes" in 5.i.	Editorial	Refered to Doug Law for possible TSO template update
16	TSO C-164A Night Vision Goggles	6	7.a	Any other data needed for the proper installation, certification, use, or for continued compliance with the TSO, of the night vision goggles.	What is meant by "installation" of the NVGs? This may be unclear to the manufacturers seeking TSO. Section 3.a clearly stated that the "…equipment is portable (battery powered), with no interface with aircraft systems. Manufacturers wishing to develop night vision goggles that utilize alternate power sources must apply for a deviation..."	Remove references to installation of NVG in this context. If there is added value in addressing installation, please clarify what this entails.	Conceptual	Modified. Rewrote required statement in 5.a.(1)